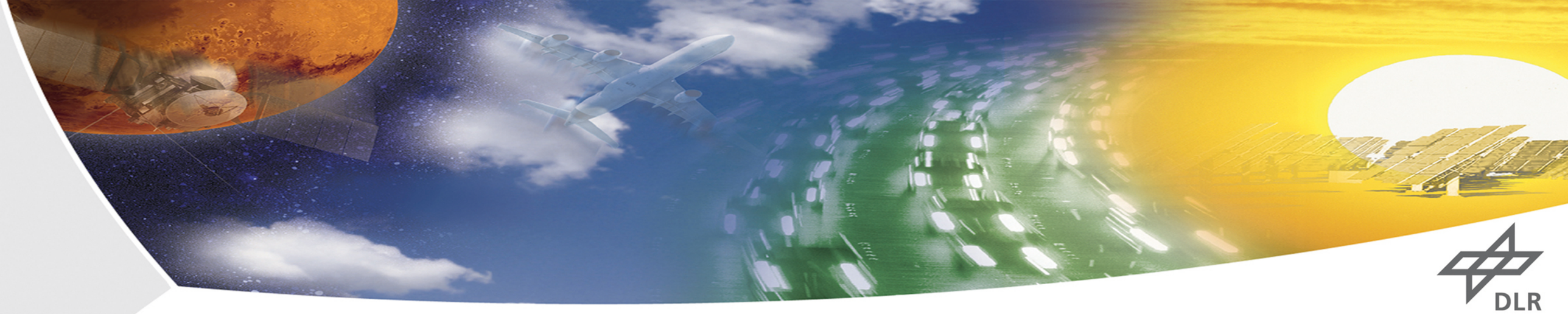


Possibilities and constraints in the use of very high spatial resolution UltraCamX airborne imagery and Digital Surface Models for classification in densely built-up areas: a case study Berlin

Corinna Brüßhaber, Anna Maria Trosset, Tilman Bucher, DLR - German Aerospace Center - Inst. of Robotics and Mechatronics, Berlin, Germany

UltraCamX

This is the first step of an ongoing study which is conducted in the context of two current PhD theses at the DLR in Berlin-Adlershof. One goal of this introductory step is to present the novel multispectral and height information data sets of Berlin which were acquired by the matrix camera UltraCamX (UCX) and processed with the automatic processing chain at the DLR. Furthermore we present additional benefits of this kind of data to issues of urban remote sensing. This is done by pointing out the urban land cover and urban structure in a representative part near the city centre of Berlin. It is performed with suitable methodology like object-oriented classification and spatial analysis in Geographical Information Systems (GIS). Difficulties in the classification within shadows, especially the problem of not visible areas within inner courtyards as typical phenomenon of Berlin tenements are analyzed; they will be addressed in subsequent studies. It is planned to transfer the developed rule base and the gained knowledge to the whole city area of Berlin.

Aerial Survey

Berlin City 2008

3D-surface view of the DSM automatically textured with the true-orthoimage

Classification result detailed

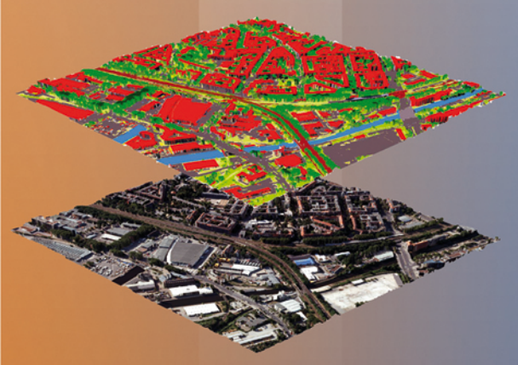
structure type predominantly residential use

typical sports ground

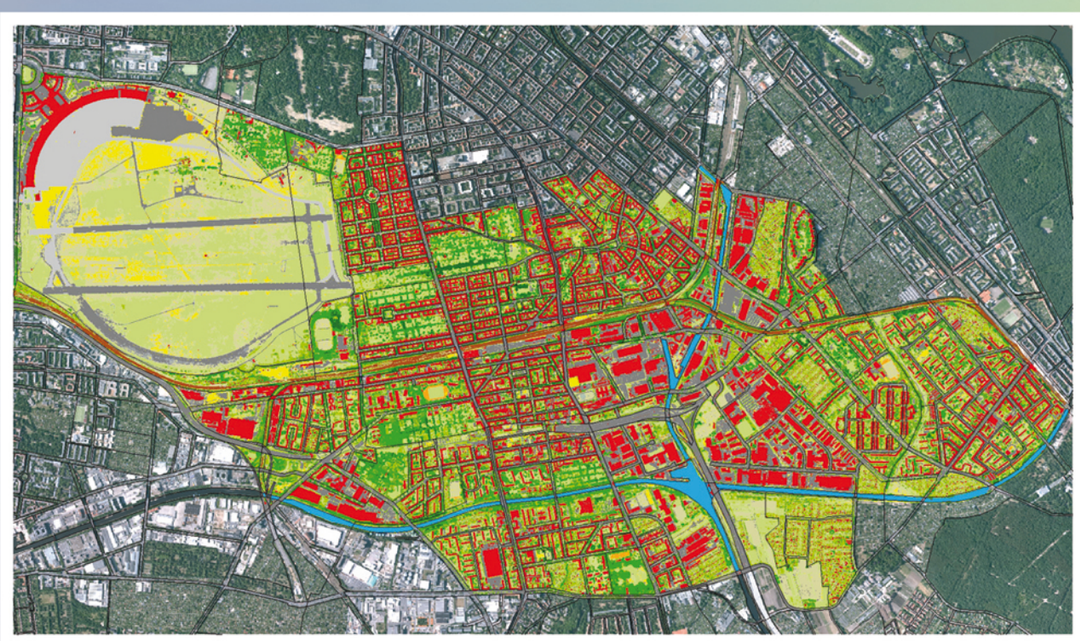
With the availability of large digital frame cameras like the UltraCamX (UCX) additional benefits through a combination of high-resolution multispectral aerial images with highly accurate digital surface models emerge. This ongoing study examines the level of detail of urban information that can be extracted. High resolution and the unprecedented geometric accuracy of the multispectral and the 2.5D object information enable the derivation of detailed and characteristic object features. The method of object-based classification is not only used to extract meaningful objects, even more important is a detailed assessment of semantic relationships. Our study shows the explicit advantage of high geometric resolution to increase the stability of classification and the number of classes in a representative area of Berlin.

TrueOrtho image (X/Y 0,15m; Z 0,10m)

3D surface modells and applications



Applications of the UCX Data for urban remote sensing



Surface proportioins per statistical block [%]

	building	sealed	unsealed	vegetation > 2m	unclassified
(1) Dense built-up	64,39	2,02	10,54	20,08	2,97
(2) Loose built-up	16,52	7,52	35,39	38,79	1,78
(3) Industry	49,52	14,53	19,80	8,82	7,33

Classification accuracy assessment based on error matrix

User Class \ Sample	building	meadow	veg heigh	sealed	waste / dry land	water body	sport field	sand	Sum
Confusion Matrix									
building	302	0	0	0	0	0	0	0	302
meadow	0	217	0	11	120	1	6	2	357
veg heigh	0	7	366	4	3	1	0	1	382
sealed	2	0	0	192	0	2	0	6	202
waste / dry land	0	6	0	21	140	1	10	22	200
water body	0	0	0	0	0	490	0	0	490
sport field	0	0	0	0	0	0	157	0	157
sand	0	0	0	0	17	0	0	153	170
unclassified	2	0	0	8	2	0	0	5	17
Sum	306	230	366	236	282	495	173	189	
Accuracy									
Producer	0.987	0.943	1.000	0.814	0.496	0.990	0.908	0.810	
User	1.000	0.608	0.958	0.950	0.700	1.000	1.000	0.900	
Heilden	0.993	0.739	0.979	0.877	0.581	0.995	0.952	0.852	
Short	0.987	0.586	0.958	0.780	0.409	0.990	0.908	0.743	
KIA Per Class	0.985	0.933	1.000	0.795	0.448	0.987	0.901	0.794	
Totals									
Overall Accuracy	**0.886**								
KIA	**0.867**								

German Aerospace Center (DLR e.V.)
corinna.bruesshaber@dlr.de
anna-maria.trosset@dlr.de

DLR **Deutsches Zentrum für Luft- und Raumfahrt** e.V.
in der Helmholtz-Gemeinschaft